Mid-upper Arm Circumference Based Undernutrition among Bengalee Children of Chapra, West Bengal, India

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Abstract

Objective: To investigate age and sex variations in undernutrition using mid-upper arm circumference (MUAC) cut-off values among 2016 (930 boys and 1086 girls). 3-5 years old rural children of Bengalee ethnicity at 66 Integrated Child Development Services (ICDS) Centers of Nadia District, West Bengal, India.

Methods: In a cross sectional study in west Bengal of India, MUAC was measured using standard technique. A total of 2028 children (935 boys and 1093 girls) from 66 ICDS centers were enrolled in this study. The response rate was approximately 95%.

Findings: Mean MUAC among boys was higher than girls at all ages except 5 years. Significant sex differences were not observed over ages. The age-combined rates of overall (moderate and severe) undernutrition among boys (38.49%) was higher than among girls (32.22%).The age-combined rates of moderate undernutrition were 36.34% and 31.03% among boys and girls, respectively. The rates of severe undernutrition were 2.15% and 1.20% among boys and girls, respectively. There were sex differences in both moderate and severe undernutrition. In general, there was an increasing trend in the rates of overall undernutrition from 3 to 5 years in both sexes.

Conclusion: These children were experiencing severe nutritional stress.

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Key Words: Children, Preschool; Anthropometry; Nutritional Status; Undernutrition; India

Introduction

Undernutrition during infancy and childhood substantially raises vulnerability to infection and disease and increases the risk of premature death. Among children in developing countries, malnutrition is an important factor contributing to illness and death. Malnutrition during

childhood can also affect growth potential and the risk of morbidity and mortality in later years of life[1]. In developing courtiers like India, undernutrition is one of the greatest problems among children. The country is still being confronted with this problem. As in other developing nations, malnourishment is a burden on a considerable proportion of population, the most vulnerable being the youngest of the country[2].

It is well known that undernutrition in childhood is one of the reasons behind the high child mortality rates in developing countries. It is highly detrimental for the future of those children who survive[3]. Chronic under-nutrition in childhood is linked to slower cognitive development and serious health impairments later in life that reduce the quality of life of individuals[4]. Nutritional status is an important index of this quality [5]. Improved child health and survival are considered universal humanitarian goals. In this respect, understanding the nutritional status of children has far reaching implications for the better development of future generations[6].

Child growth is universally used to assess adequate nutrition, health and development of individual children, and to estimate overall nutritional status and health of populations.

Compared to other health assessment tools, measuring child growth is a relatively inexpensive, easy to perform and non-invasive process[7]. Therefore anthropometric examination is an almost mandatory tool in any research on health and nutritional condition in childhood and the study of nutritional status is of great importance for the understanding of the social well being in a population[8]. Moreover, in community based studies, mid-upper arm circumference (MUAC) appears to be a superior predictor of childhood undernutrition than many other anthropometric indicators[7].

During preschool age period, children have special nutritional needs because of their extensive growth and development[9]. Therefore the MUAC is an important measurement which is often used for the assessment of nutritional status among pre-school children. Under-nutrition among pre-school children is an important public health problem in rural India[10] including West Bengal[11]. However, there exists scanty information of the prevalence of undernutrition among preschool children in India [12] and West Bengal[11,13].

The MUAC is a relatively simple measurement /index, but with a fixed cutoff, it ignores age-related changes. Compared with weight-for-height, MUAC has a sensitivity of 24.6% and a specificity of 94.8%[14] and appears to be a better predictor of childhood mortality than weight-for-height[15].

Keeping these in mind, the aim of the present study was to evaluate the nutritional status of rural Bengalee preschool children from Chapra Block, Nadia District, West Bengal, India, using the World Health Organization[7] age and sex-specific MUAC cut-off points.

Subjects and Methods

This cross sectional study was undertaken at Chapra Block, Nadia District, West Bengal, India. The study area is situated at the India–Bangladesh international border, 140 km from Kolkata, the provincial capital of West Bengal. The area is remote and mostly inhabited by Bengalee Muslims. All preschool children (3–5 years old) living in Chapra Block are enrolled at these centers. The ICDS authorities are allocated 80 paise (approximately 2 US cents) per head (child) per day by the Government of India to provide supplementary nutrition to the children. This financial assistance ensures that each child is given a porridge consisting of 41 g of rice and 17 g of lentils per day.

Sixty six ICDS centers were randomly selected out of 186 centers of the Chapra Block. The response rate was approximately 95%. A total of 2028 children (935 boys and 1093 girls) aged 3–5 years were measured, out of whom 12 individuals (5 boys and 7 girls) were excluded because of missing data. The final sample size was 2016 (930 boys and 1086 girls). Age and ethnicity of the subjects were verified from official records.

Age estimation of the subjects: Ages of the children were ascertained from the Anganwadi

registers and subsequently confirmed by parents of the children. For analyses, age was grouped in to twelve months intervals.

Anthropometric measurement: The MUAC measurement was taken (in centimeters) by first author (SB) on each subject following the standard techniques [16]. Technical errors of measurements (TEM) were found to be within reference values [17] and thus not incorporated in statistical analyses. Between sexes differences in means of MUAC was tested by Student's t-test. Age–group variation in MUAC was tested by One Way ANOVA test. Statistical significance was set at *P*<0.05.

Assessment of nutritional status: Nutritional status of the children was evaluated using the following scheme[7]:

Moderate undernutrition: < -2 standard deviation (SD) Z-score value

Severe undernutrition: < -3 SD Z-score value

Where SD refers to the age and sex-specific WHO standard deviations Z-score value of MUAC.

The – 2 SD and – 3 SD of age and sex-specific cut-off points are given in table 1.

Table 1: The WHO (1995) recommended cut-off points for mid-upper arm circumference (cm) by age and sex

Age in years	Boys		Girls	
	- 2 SD	- 3 SD	-2 SD	-3 SD
3	13.8	12.4	13.6	12.2
4	14.1	12.6	13.9	12.4
5	14.2	12.6	14.1	12.5

SD: Standard Deviation

combined rates of moderate undernutrition were 36.34% and 31.03% among boys and girls, respectively. The rates of severe undernutrition were 2.15% and 1.20% among boys and girls, respectively. These results indicated that there existed sex differences in both moderate and severe undernutrition. In general, there was an increasing trend in the rates of overall undernutrition from 3 to 5 years in both sexes.

Findings

The age and sex specific mean (SD) of MUAC are presented in Table 2. Results revealed that mean MUAC among boys was higher than girls at all ages except 5 years. Significant sex differences were not observed over ages.

The prevalence of under-nutrition among the pre-school children is presented in Table 3. The age-combined rates of overall (moderate and severe) undernutrition among boys (38.49%) was higher than in girls (32.22%). The age-

Discussion

Available evidences show that MUAC is the best (i.e. in terms of age independence, precision, accuracy, sensitivity and specificity) case–detection method for severe and moderate malnutrition and that it is also simple, cheap and acceptable[18]. Consistently high case of fatality rates in hospitalized Kenyan children of all ages between 12 – 59 months with low MUAC values, (≤ 11.5 cm.) has been reported; this result[19] suggested that unadjusted (i.e. by age) MUAC may be useful in clinical settings. Velzeboer and others[20], reported in a comparison of W/H and MUAC in Guatemala, that, younger children

Table 2: Age and sex specific distribution of mid-upper arm circumference

Age in years	Boys		Girls			
	No	Mean (SD)	No	Mean (SD)	*t*- value	*P value*
3	322	14.21 (0.87)	354	14.13 (0.91)	1.11	0.27
4	313	14.38 (0.92)	398	14.35 (0.90)	0.44	0.66
5	295	14.52 (0.93)	334	14.53 (0.97)	-0.09	0.93

F (boys)=1.195, P=0.20; F (girls)=3.129, *P*<0.001; SD: Standard Deviation

Table 3: Assessment of nutritional status of the studied pre-school children

Age in year	Boys Undernutrition				Girls Undernutrition				Sex Combined
	No	Severe	Moderate	Overall	No	Severe	Moderate	Overall	
3	322	4(1.24)	105(32.61)	109(33.85)	354	5(1.41)	111(31.36)	116(32.77)	225(33.28)
4	313	9(2.88)	117(37.38)	126(40.26)	398	4(1.01)	113(28.39)	117(29.4)	243(34.18)
5	295	7(2.37)	116(39.32)	123(41.69)	334	4(1.20)	113(33.83)	117(35.30)	240(38.16)
Total	930	20(2.15)	338(36.34)	358(38.49)	1086	13(1.20)	337(31.03)	350(32.22)	708(35.11)

Figures in parentheses indicate percentages

tended to become upset and agitated during both height and weight measurements and that no such behavior was observed during the measurement of MUAC. They also opined that, this measurement can be taken by minimally trained health workers. Therefore measurement of MUAC is a quick and reliable method for screening children to identify those who are seriously malnourished[21]. There are several practical and theoretical advantages of using MUAC rather than weight-for-height for the determination of nutritional status[18].

The prevalence of undernutrition in the present study clearly showed a higher rate than the pre-school children of Jaffna, Sri Lanka in post-Exodus period[22] That study had reported that the percentages of the preschool children under the age groups 5 years affected by severe and moderate acute malnutrition were 5.1% and 19.1%, respectively. In Indian context (Figure-1) the prevalence of undernutrition was lower among the present sample as compared to those reported from Punjab (38.5%)[21] and Orissa (58.0%)[23]. However, it was higher than urban children of Kolkata[2].

Our study clearly indicated that the nutritional status of these pre-school children was serious with high rates of undernutrition in both sexes. Considering stunting, underweight and wasting among the same population, high prevalence of undernutrition was also noticed[13]. It has been reported that there is little improvement in child undernutrition for the last decade. Now the government of India is
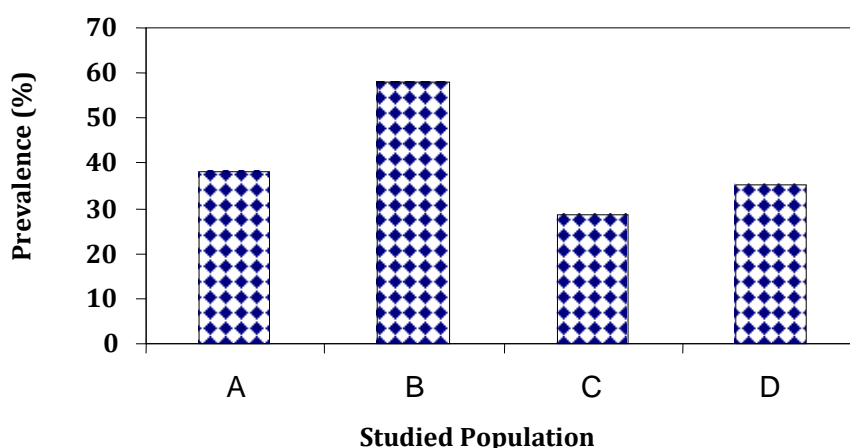

Fig. 1: Comparison of the overall (age and sex combined) prevalence (%) of undernutrition among the preschool children based on mid-upper arm circumference

A = Punjab (Kaur et al 2005)   B = Orissa (Mishra and Mishra 2007)
C = Kolkata (Chaterjee and Saha 2008)   D = Present Study

going to restructure its program for nutritional intervention for children up to age of 6 years. The Prime Minister of India had, in a recent letter to the Women and Child Development (WCD) ministry, expressed concern over the poor implementation of the ICDS programme pointing out that it had failed to curb child malnutrition. Therefore, the WCD ministry has recommended that the amount spent on supplementary nutrition for children between 6 months to 72 months will be increased from Indian Rupees (Rs.) 2/- to Rs. 4/, while severely malnourished children in the same age group will get Rs. 6/- per child per day instead of Rs. 2.70 at present[24].

Nevertheless, it must be mentioned here that detailed relationships between morbidity, mortality and various socio-economic factors with childhood undernutrition, based on MUAC, are not being reported in this study. This is a limitation of our study.

Conclusion

In conclusion, our study clearly indicated that the nutritional status, based on MUAC, of these pre-school children was serious with high rates of undernutrition in both sexes. We suggest that more studies dealing with undernutrition based on MUAC should be undertaken among pre-school children from different parts of India. It has been recommended that MUAC be used to determine nutritional status among children of different ethnic groups worldwide, particularly in developing countries[25]. Such investigations will allow us to not only to compare the rates of three conventional measures of undernutrition with MUAC, but also help to demonstrate the enhanced utility and effectiveness of the latter measure. Since the vast majority of the Indian population reside in rural areas where the rates of childhood undernutrition are very high, such studies should concentrate on rural pre-school children. Effective health and nutritional promotion programmes can be formulated based on the findings of these researches with the ultimate objective of reducing childhood nutrition in these areas.

Acknowledgment

Conflict of Interest: None

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